

IN THE CLAIMS:

1. (Previously Provided) A breathing assistance apparatus adapted to deliver humidified gas at a desired level of humidity or at a desired temperature within a conduit to a patient using open loop control comprising:

a humidifier having an electrical input power and capable of humidifying said gas up to a level of humidity prior to delivery to said patient, said level of humidity depending on said input power to said humidifier,

a conduit configured to convey said humidified gas from said humidifier to a patient,

a conduit heater having an electrical input power, and being associated with said conduit wherein the gas flowing through said conduit are heated either directly or indirectly by said conduit heater whereby the level of heating depending on said input power to said conduit heater,

a conduit heater power monitor providing an output indicative of the input power to said conduit heater, and

a controller or processor configured or programmed to:

(a) monitor said input power supplied to said conduit heater and to determine a parameter indicative of the resistance or temperature of said conduit heater or the flow rate through said conduit based upon said input power;

(b) determine based on at least said parameter the required electrical power input to said humidifier to deliver said gas to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;

(c) supply as said input power to said humidifier a level of power substantially similar to said determined power input to said humidifier;

(d) continuously monitor said parameter, and when a change in said parameter is greater than a first threshold, said controller or processor reverts to said instruction (a).

2. (Previously Provided) A breathing assistance apparatus as claimed in claim 1 further comprising the steps of continuously monitoring said parameter, and when a change in said parameter is greater than a first threshold, said controller or processor reverts to said instruction (a), when a change in said parameter is greater than a second threshold, said controller or processor reverts to instruction (b), said second threshold relating to a lesser change in the flow rate than said first threshold.

3. (Previously Provided) A breathing assistance apparatus as claimed in claims 1 or 2 wherein said breathing assistance apparatus further comprises:

an ambient temperature sensor providing an indication of the exterior temperature or said controller or processor storing an assumption of the exterior temperature used as an indication of the exterior temperature; and said instruction (b) further comprises determining based on at least said indication of the exterior temperature the required power input to said conduit heater to deliver said gas to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature; and

said instruction (c) further comprises supplying as said input power to said conduit heater a level of power substantially similar to said determined power input to said conduit heater.

4. (Previously Provided) A breathing assistance apparatus as claimed in claim 3 wherein said first threshold relates to the rate of change of said parameter with respect to

time, wherein when said rate of change is greater than said first threshold said controller or processor reverts to said instruction (a).

5. (Previously Provided) A breathing assistance apparatus as claimed in claim 4 wherein said rate of change or said change in said parameter indicates a decrease in flow said controller or processor pauses for a first delay before said controller or processor reverts to said instruction (a) and if said rate of change or said change indicates an increase in flow said controller or processor pauses for a second delay before said controller or processor reverts to said instruction (a), said second delay being longer than said first delay.

6. (Previously Presented) A breathing assistance apparatus as claimed in claim 1 configured to estimate the temperature of said conduit heater based on said determined resistance of said conduit heater and at least one characteristic of said conduit heater.

7. (Previously Provided) A breathing assistance apparatus as claimed in claim 6 wherein said indication of the temperature or resistance is used by said controller or processor at least in said instruction (d) as said parameter relating to the flow rate of said gas.

8. (Previously Presented) A breathing assistance apparatus as claimed in claim 7 wherein said input power to said conduit heater comprises a voltage signal and a current signal, and said indication of the temperature or resistance relates at least in part to said voltage signal or said current signal.

9. (Previously Provided) A breathing assistance apparatus as claimed in claim 8

wherein said humidifier comprises a humidification chamber adapted to receive a volume of water and water heater to heat said water to produce water vapour within said chamber in use, said gas passing through said water vapour in said chamber thereby being humidified, said instruction (a) further comprising:

- i) energising said water heater to heat said water towards a first condition,
- ii) continuously monitoring said parameter or a variable indicative of a property of said water heater, until said variable or said parameter indicates that said water has substantially reached said first condition,
- iii) determining said parameter based on at least said variable and said indication of the external temperature.

10. (Previously Provided) A breathing assistance apparatus as claimed in claim 3 wherein the determination of said power to said humidifier in said instruction (b) is also based on said indication of the external temperature.

11. (Previously Presented) A breathing assistance apparatus as claimed in claim 1 wherein said breathing assistance apparatus further comprises a gas supply means adapted to supply gas to said humidifier at a required pressure and resulting flow rate.

12. (Previously Presented) A breathing assistance apparatus as claimed in claim 11 wherein said gas supply provides an output signal representative the level of electrical output to said gas supply, said signal being supplied to said controller or processor from which the flow rate of said humidified gas is determined.

13. (Previously Presented) A breathing assistance apparatus as claimed in claim 12 wherein said gas supply comprise a fan driven by a variable speed electric motor.

14. (Previously Presented) A breathing assistance apparatus as claimed in claim 13 wherein said parameter is based on the current drawn by said variable speed motor.

15. (Previously Presented) A breathing assistance apparatus as claimed in claim 1 wherein said breathing assistance apparatus further comprises a gas flow rate sensor from which said parameter is determined directly.

16. (Previously Presented) A breathing assistance apparatus as claimed in claim 9 wherein said humidifier further comprises:

a chamber sensor providing an indication of the temperature of said water heater and providing an indication of the electrical power drawn by said water heater,

wherein said variable is indicative of said indicator of the temperature of said water heater or said indication of the power drawn by said water heater.

17. (Previously Provided) A breathing assistance apparatus as claimed in claim 16 wherein said parameter at least in said instructions (a), (b) or (d), is defined as the value of said power drawn by said water heater divided by said temperature of said water heater.

18. (Cancelled)

19. (Currently Amended) A method of delivering humidified gas at a desired level of

humidity or at a desired temperature to a patient using an open loop controlled humidifier comprising the steps of:

- (a) monitor the power input to said conduit heater;
- (b) determining a parameter relating to the resistance or temperature of said conduit heater or the flow rate of said gas through said humidifier from said power input;
- (c) ~~(b)~~ determining based on at least said parameter the required electrical power to said humidifier to deliver said gas to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;
- (d) ~~(c)~~ supplying a level of power to said humidifier substantially similar to said determined power;
- (e) ~~(d)~~ continuously monitoring said parameter, and when a change in said parameter is greater than a first threshold, indicating a change in the flow rate of said gas, revert to step (a).

20. (Currently Amended) A method as claimed in claim 19 wherein step (e) ~~(d)~~ further comprising: when a change in said parameter is greater than a second threshold indicating said controller or processor reverts to ~~instruction (b)~~ step (c), said second threshold relating to a lesser change in the flow rate than said first threshold.

21. (Currently Amended) A method as claimed in claims 19 or 20 further comprising the steps:

- conveying said humidified gas to a patient,
- heating the conveyed gas either directly or indirectly using a conduit heater;
- sensing or making an assumption of the exterior temperature;

and said ~~instruction (b)~~ step (c) further comprises determining based on at least said indication of the exterior temperature the required power input to said conduit heater to deliver said gas to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;

and said ~~instruction (c)~~ step (d) further comprises supplying as said input power to said conduit heater a level of power substantially similar to said determined power input to said conduit heater.

22. (Currently Amended) A method as claimed in claim 21 wherein said first threshold relates to the rate of change of said parameter with respect to time, wherein when said rate of change is greater than said first threshold said controller or processor reverts to said ~~instruction (a)~~ step (b).

23. (Currently Amended) A method as claimed in claim 22 wherein said rate of change or said change in said parameter indicates a decrease in flow said controller or processor pauses for a first delay before said controller or processor reverts to step (b) ~~(a)~~ and if said rate of change or said change indicates an increase in flow said controller or processor pauses for a second delay before said controller or processor reverts to step (b) ~~(a)~~, said second delay being longer than said first delay.

24. (Previously Presented) A method as claimed in claim 21 further comprising the step of monitoring the input power supplied to said conduit heater to provide an indication of the resistance or temperature of said conduit heater.

25. (Currently Amended) A method as claimed in claim 24 wherein said indication of the temperature or resistance is used at least in step (e) ~~(d)~~ as said parameter relating to the flow rate of said gas.

26. (Previously Presented) A method as claimed in claim 25 wherein said input power to said conduit heater comprises a voltage signal and a current signal, and said indication of the temperature or resistance relates at least in part to said voltage signal and/or said current signal and said input power to said conduit heater.

27. (Currently Amended) A method as claimed in claim 26 wherein said humidifier comprises a humidification chamber adapted to receive a volume of water and water heater to heat said water to produce water vapour within said chamber in use, said gas passing through said water vapour in said chamber thereby being humidified, said ~~instruction (a)~~ step (b) further comprising:

- i) energising said water heater to heat said water towards a first condition,
- ii) continuously monitoring said parameter or a variable indicative of a property of said water heater, until said variable or said parameter indicates that said water has substantially reached said first condition,
- iii) determining said parameter based on at least said variable and said indication of the external temperature.

28. (Currently Amended) A method as claimed in claim 21 wherein the determination of said power to said humidifier in said ~~instruction (b)~~ step (c) is also based on said indication of the external temperature.

29. (Previously Presented) A method as claimed in claim 19 further comprising the step of supplying gas to said humidifier at a required pressure and resulting flow rate.

30. (Previously Presented) A method as claimed in claim 29 further comprising the step of determining the level of electrical power required to supply said gas at a required pressure and resulting flow rate, from which the flow rate of said humidified gas is determined.

31. (Previously Presented) A method as claimed in claim 29 wherein said gas is supplied by a fan driven by a variable speed electric motor.

32. (Previously Presented) A method as claimed in claim 31 wherein said parameter is based on the current drawn by said variable speed motor.

33. (Previously Presented) A method as claimed in claim 19 wherein said parameter is determined directly from a gas flow rate sensor.

34. (Previously Presented) A method as claimed in claim 27 further comprising the step of:

sensing the temperature of said water heater and providing an indication of the electrical power drawn by said water heater,

wherein said variable is indicative of the temperature of said water heater or said indication of the power drawn by said water heater.

35. (Previously Presented) A method as claimed in claim 27 further comprising the step of:

sensing the temperature of said water heater and providing an indication of the electrical power drawn by said water heater,

wherein said variable is indicative of the temperature of said water heater or said indication of the power drawn by said water heater.

36. (Currently Amended) A breathing assistance apparatus adapted to deliver humidified gas at a desired level of humidity or at a desired temperature to a patient using open loop control comprising:

humidifier means having an electrical input power ~~and capable of~~ for humidifying said gas up to a level of humidity prior to delivery to said patient, said level of humidity depending on said electrical input power to said humidifier means,

conduit means for conveying said humidified gas from the humidifier means to the patient,

conduit heating means having an electrical input power, and being associated with said conduit means, wherein the gas flowing through said conduit means is heated either directly or indirectly by said conduit heating means, whereby the level of heating depends on said electrical input power to said conduit heating means, and

means for monitoring the electrical input power to said conduit heating means and determining a parameter relating indicative of the resistance or temperature of said conduit heating means or to the flow rate of said gas through said apparatus based on said input power to said conduit heating means;

means for determining based on at least said parameter the required electrical power

input to said humidifier means to deliver said gas to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;

means for supplying as said input power to said humidifier means a level of power substantially similar to said determined power input to said humidifier means;

means for continuously monitoring said parameter, and when a change in said parameter is greater than a first threshold, indicating a change in the flow rate of said gas, the flow rate is determined again.